The combined use of CALIOP, MODIS and OMI aerosol and cloud products for calculating direct aerosol radiative effects

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We describe a technique for combining CALIOP aerosol backscatter, MODIS spectral AOD (aerosol optical depth), and OMI AAOD (absorption aerosol optical depth) measurements for the purpose of estimating full spectral sets of aerosol radiative properties, and ultimately for calculating direct aerosol radiative effects. We will present first results using 1-month of collocated CALIOP V3, MODIS and OMI data collected in October 2007, as well as a test of our methodology using airborne observations in the ARCTAS field experiment. As a prerequisite for the application of our methodology to the actual satellite observations, we assessed the consistency between comparable measurement quantities from the different A-Train sensors. For eight months in 2007 and 2009, comparisons of the standard MODIS-Aqua AOD data to AOD calculated from CALIOP aerosol extinction profile data show differences in global, monthly mean, over-ocean AOD (532nm) between CALIOP and MODIS ranging between between 0.025 and 0.04 for CALIOP V3, with CALIOP generally biased low. Differences for CALIOP V2 are often smaller, but correlation with MODIS AOD is significantly lower.

Anelastic processes in minerals at high temperature: Examples of quartz and spinel

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Features of recent mechanical spectroscopic studies in Cambridge will be reviewed. The first measurements of higher-order harmonic responses of coelastic materials at displacive phase transitions are reported: Second and third harmonics of strain have been measured by forced torsion pendulum for quartz at the high-low transition. The incommensurate phase and the highly non-linear thermal expansion of quartz at this transition may play a role in controlling higher order elastic moduli. Jerky elastic and strain responses to applied stress also reveal themselves in such experimental arrangements, and we have seen the development of power law distributions of such elastic noise in a number of systems. Self-induced defects appear to lead to such crackling microstructures.

As a contrasting example, the high temperature behaviour of $MgAl_2O_4$ spinel is known to be dominated by kinetic rearrangements of Mg and Al cations as the system undergoes non-convergent order-disorder. We have measured the anelastic loss associated with such order-disorder processes in crystals and ceramics of spinel at ambient and high pressure. The loss is revealed as a strong anelastic relaxation, with well-defined activation energy and relaxation time, in the seismic frequency range. Finally, the implications for seismic damping in ringwoodite spinel are considered.